CLAIMS

1. An optoelectronic module having;

optical fibers terminating in fiber facets on an end face of an optical fiber block;

a submount joined to said end face;

an edge emitting laser diode array bonded to said submount in optical alignment with said facets and operatively connected to laser driver circuits of said module; and

a cap joined to both said submount and to said end face for enclosing said array and a portion of said end face including said facets.

2. The module of Claim 1 wherein said cap is joined in hermetic sealing relationship to said submount and to said end face.

3. The module of Claim 1 wherein said cap has a cap bottom bonded to said submount and encompassing said array and a cap end surface bonded to said end face of said optical fiber block.

4. The module of Claim 1 wherein said cap comprises a cap side wall portion bonded to said substrate and a separate cap cover bonded to said cap side wall.

5. The module of Claim 1 wherein said array is encapsulated in epoxy resin substantially transparent to light wavelengths passing between said array and said fiber facets.

6. The module of Claim 5 wherein said epoxy resin comprises silicone resin.

7. The module of Claim 5 wherein said epoxy resin also encapsulates said fiber facets on said end face.

8. The module of Claim 5 wherein said cap has an injection hole therein for introducing said epoxy resin in an initially fluid uncured state into said chamber such that the fluid resin is contained by said cap in said uncured state.

9. The module of Claim 5 wherein said epoxy resin comprises a relatively compliant inner resin encapsulating said array and a relatively hard outer resin covering said inner resin.

10. An optoelectronic module comprising;

optical fibers terminating in fiber facets on an end face of an optical fiber block;

a surface emitting laser diode or photo diode array bonded to a submount; and

a spacer interposed between and affixed to said submount and to said end face for enclosing said diode array and a portion of said end face including said fiber facets.

11. The module of claim 10 wherein said diode array has a top surface facing said end face and a plurality of diode elements on said top surface, and wire bonds arcing from said top surface to connect said diodes to conductors on said submount, wherein said spacer has a spacer width sufficient to accommodate said diode array and said wire bonds between said submount and said end face.

12. The module of Claim 10 wherein said spacer is a closed perimeter frame and is bonded in hermetic relationship to said submount and to said end face for sealing said diode array and said fiber facets.

13. The module of Claim 10 wherein said diode array is encapsulated in resin substantially transparent to light transmissions between said diode array and said fiber facets.

14. The module of claim 12 wherein said spacer has a resin injection port therein for admitting sealing resin into a chamber defined by said spacer between said submount and said end face.

15. The module of claim 14 wherein said resin injection port is sealed with said sealing resin thereby to seal said chamber.

16. The module of Claim 10 wherein said spacer is bonded with epoxy resin to each of said submount and said end face.

17. The module of Claim 10 wherein said spacer is hermetically sealed to said submount and to said end face.

18. A method of sealing an optoelectronic assembly for use in a transmitter or receiver module comprising the steps of:

providing an optical fiber block supporting a plurality of optical fibers each terminating in a fiber facet on an end face of said block to define a fiber facet array;

providing a submount having a top surface and a side surface;

bonding a laser diode array chip to said top surface of said submount;

providing a cap having an end surface;

affixing said cap to said submount;

optically aligning said diode array with said fiber facet array; and

bonding said submount to said optical fiber block.

19. The method of Claim 18 wherein said step of optically aligning comprises placing said side surface and said end surface in contact with said fiber block during said aligning.

20. The method of Claim 18 wherein said cap cooperates with said fiber block to define a fluid containment enclosure encompassing said laser diode array chip; and further comprising the step of applying liquid resin in said fluid containment enclosure to encapsulate said laser diode array chip.

21. The method of Claim 18 wherein said cap has three side walls and a top, said end face providing a fourth wall and said substrate providing a bottom thereby to define a chamber containing said laser diode array and said fiber facet array.

22. The method of Claim 21 wherein said cap has a hole through said top for admitting liquid resin into said chamber.

23. The method of Claim 22 wherein said hole is sealed with resin.

24. The method of Claim 21 wherein said cap comprises a cap sidewall portion and a separate cap top, and said step of affixing comprises the step of affixing said cap sidewall portion to said submount to thereby define with said end face a fluid containment enclosure

for containing liquid resin over said diode array, and then affixing said cap top to said cap sidewall thereby to define said chamber.

25. A method of sealing an optoelectronic assembly for use in a transmitter or receiver module comprising the steps of:

providing an optical fiber block supporting a plurality of optical fibers each terminating in a fiber facet on an end face of said block to define a fiber facet array;

providing a submount;

bonding a diode array chip to said submount;

affixing a containment dam to said submount for defining a fluid containment enclosure encompassing said diode array chip;

assembling said submount, said containment dam and said optical fiber block with said laser diode array chip in optical alignment with said fiber facet array; and

applying liquid resin to encapsulate said diode array chip.

26. The method of Claim 25 wherein said step of assembling comprises bonding said containment dam to said fiber block.

27. The method of Claim 25 wherein said step of assembling comprises bonding said submount and said containment dam to said fiber block.

28. The method of Claim 25 wherein said containment dam has one or more end surfaces and said step of assembling comprises bonding said one or more end surfaces to said fiber block.

29. The method of Claim 25 wherein said submount has a side surface for bonding to said fiber block, said containment dam has one or more end surfaces, and said step of affixing comprises the step of aligning said one or more end surfaces in coplanar relationship with said side surface.

30. The method of Claim 29 wherein said step of assembling comprises the step of bonding said side surface and said one or more end surfaces to said end face of said fiber block.

31. The method of Claim 25 wherein said containment dam cooperates with said optical fiber block to make a closed chamber containing said diode array and said fiber facet array.

32. The method of Claim 25 wherein said containment dam comprises a cap having three side walls and a cap top, said end face providing a fourth wall and said substrate providing a bottom thereby to define a closed chamber containing said diode array and said fiber facet array.

33. The method of Claim 32 wherein said cap top is unitary with said side walls and further comprising a hole through said cap for admitting said liquid resin into said closed chamber.

34. The method of Claim 33 wherein said hole is through said cap top.

35. The method of Claim 32 wherein said cap comprises a cap sidewall and a separate cap top, and said step of affixing a containment dam comprises the step of affixing said cap sidewall to said submount to thereby define said fluid containment dam in cooperation with said end face.

36. The method of Claim 35 further comprising the step of affixing a cap top to said cap sidewall thereby to define a closed chamber containing said laser diode array and said fiber facet array.

37. The method of Claim 25 wherein said containment dam is at least partly defined by a cap having a plurality of cap side walls and a cap top and said cap cooperates with said optical fiber block to make a closed chamber containing said diode array and said fiber facet array.

38. The method of Claim 25 wherein said containment dam is at least partly defined by a spacer interposed between opposing surfaces of said substrate and said fiber block.

39. The method of Claim 38 wherein said spacer has first and second end surfaces, and wherein said step of affixing comprises the step of affixing said first of said end surfaces to said submount and said step of assembling comprises the step of bonding said second of said end surfaces to said fiber block.

40. The method of Claim 39 wherein said step of bonding said second of said end surfaces comprises the step of bonding said second of said end surfaces to said end face of said fiber block.

41. The method of any of Claims 38 to 40 wherein said spacer is a closed perimeter frame and said step of applying said liquid resin to said diode array is performed after affixing said spacer to said submount about said diode array, and then performing said assembling step by bonding said frame to said fiber block.

42. The method of any of Claims 38 to 40 wherein said spacer has an side opening and said step of applying liquid resin is performed after said steps of affixing and assembling by introducing liquid resin through said side opening.

43. The method of Claim 42 further comprising the step of sealing said side opening of the spacer frame with resin.

44. An optoelectronic data communication module comprising a housing module with electronic transmitter or receiver circuits in said housing module;

an optical fiber block having optical fibers terminating in fiber facets on an end face of said block;

a light emitter / detector diode array mounted on a submount in optical alignment with said facets and operatively connected to said circuits; and

chamber defining means bonded to said submount and to said block for enclosing said diode array and at least a portion of said end face including said facets.

45. The module of Claim 44 wherein said submount is also bonded to said fiber block.

46. The module of Claim 44 wherein said submount is bonded to said fiber block and said chamber defining means is also bonded to said fiber block.

47. The module of Claim 44 wherein said chamber defining means is intermediate to said submount and said fiber block and said submount is supported to said fiber block by said chamber defining means.

48. The module of Claim 44 wherein said submount has a side surface and said chamber defining means has one or more end surfaces coplanar with said side surface such that both said side surface and said one or more end surfaces can contact said end face whereby alignment of said array to said facets is facilitated and said side surface and said one or more end surfaces are bonded to said fiber block for increased mechanical strength.

49. The module of Claim 48 wherein said chamber defining means is bonded in substantially sealing engagement to said submount and said one or more end surfaces is bonded in substantially sealing engagement with said end face such that said array and said facets are enclosed in a sealed chamber.

50. The module of any of Claims 44 through 49 wherein said chamber defining means also defines a fluid containment dam about said array and wherein said array is encapsulated in epoxy resin contained by said dam.

51. The module of Claim 44 to 49 wherein said chamber defining means is selected from the group comprised of a cap enclosure and a frame enclosure.

52. The module of Claim 44 wherein said chamber defining means is a cap and said one or more end surfaces is an end surface shaped as an inverted U relative to said submount.

53. The module of Claim 44 wherein said chamber defining means is a spacer defining a continuous closed perimeter and said one or more end surfaces comprises opposing surfaces of said spacer.

54. A method of making an optoelectronic assembly for use in a transmitter or receiver module comprising the steps of:

providing an optical fiber block supporting a plurality of optical fibers each terminating in a fiber facet on an end face of said block to define a fiber facet array;

providing a submount;

providing a containment dam having a bottom surface and one or more side surfaces;

bonding a diode array chip to said submount;

bonding said bottom surface of the containment dam to said submount; and

bonding one or both of said submount and said one or more side surfaces to said fiber block with said diode array chip in optical alignment with said fiber facet array.

55. The method of Claim 54 wherein said containment dam comprises a cap having three side walls and a cap top and said one or more side surfaces comprise end surfaces of said side walls and said cap top, said end face providing a fourth wall and said substrate providing a bottom thereby to define a chamber containing said diode array chip and said fiber facet array.

56. The method of Claim 55 wherein said cap comprises a cap sidewall portion and a separate cap top, and said step of affixing comprises the step of affixing said cap sidewall portion to said submount to thereby define with said end face said fluid containment enclosure, and then affixing said cap top to said cap sidewall thereby to define said chamber.

57. The method of Claim 54 wherein said containment dam comprises a sidewall portion terminating in two said end surfaces.

58. The method of Claim 57 wherein said two end surfaces are coplanar with each other.

59. The method of Claim 58 wherein said two end surfaces are also coplanar with a bonding surface of said submount such that said end surfaces and said bonding surface are all bonded to said end face of said fiber block.

60. The method of any of Claims 54 through 59 wherein said containment dam cooperates with said end face to define a fluid containment enclosure encompassing said diode array chip; and further comprising the step of applying liquid sealing resin to said diode array chip thereby to encapsulate said chip in said resin.

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